Question Paper Code : 70564

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Sixth Semester

Electrical and Electronics Engineering

EE 8601 – SOLID STATE DRIVES

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the types of load torques.

2. Draw the multi quadrant operation of drives.

3. List the drawbacks of rectifier fed DC drives.

4. How the regenerative braking is achieved in DC Drives?

5. What do you mean by Vector control?

6. Why the power factor of the slip power recovery scheme of speed control of Induction motor is low?

7. What is the basic difference between true synchronous mode and self control mode?

8. How is the speed control obtained in static Kramer drive?

9. What is meant by flux weakening schemes of control?

10. What are the advantages of using PI controller in closed loop control of dc drive?

11. (a) Derive the equations governing the motor load dynamics

Or

(b) Discuss the factors to be considered for the selection of drives

12. (a) Explain with neat circuit diagram and waveforms the working of a three phase fully controlled dc motor drive. Get the expression for the average output voltage.

Or

(b) Explain with circuit diagram and waveform the multi-quadrant chopper control of separately excited DC motor for (i) Forward Motoring (ii) Forward Braking (iii) Reverse Motoring and (iv) Reverse braking modes.

13. (a) Discuss in brief about the control of an induction motor by stator voltage variation using 3 phase voltage controller.

Or

(b) Discuss the operation of an open-loop V/f speed control with voltage source inverter fed induction motor drive.

14. (a) Discuss the Various application of three phase voltage source inverter fed synchronous motor drive

Or

(b) Discuss the methods of improving the power factor in the synchronous motor drive.

15. (a) Explain the operation of closed loop DC motor control with current and speed feedback loops.

Or

(b) Derive the transfer function of DC Motor-load system with armature voltage control.

16. (a) A 230 V, 960 rpm and 200 A separately excited dc motor has an armature resistance of 0.02W. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction, Calculate (i) duty cycle ratio of chopper for motoring operations at 350 rpm. (ii) duty cycle ratio of chopper for braking operation at rated torque and 350 rpm. (iii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated. Calculate the maximum permissible motor speed and power fed to the source.

Or

(b) A 220V, 1500 rpm, 11.6A seperately encited motor is controlled by a 1-phase fully controlled rectifier with an ac source voltage of 230V, 50Hz. Enough filter inductance is added to ensure continuous conduction for any torque greater than 25 percent of rated torque, $R_a = 2\Omega$.

(i) What should be the value of the firing angle to get the rated torque at 1000 rpm? (5)

(ii) Calculate the firing angle for the rated braking torque and 1500 rpm. (5)

(iii) Calculate the motor speed at the rated torque and $\alpha = 160°$ for the regenerative braking in the second quadrant. (5)